Expanding the Hubway Network

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Introduction

With the objective of being an accessible city, Boston is part of a public transportation system that connects it to around 175 cities and towns. Currently consisting of 145 subway stations, 177 bus routes, 8 ferry terminals, and 193 Hubway Stations (bike sharing) around the Greater Boston area, the public transportation network is constantly looking to expand its services.

In one of the City's most current efforts, residents are being asked to vote on proposed Hubway station locations. Motivated by this, I have decided to **explore a computational way in which to expand the area covered by the Hubway Network, considering the distribution of houses around the City of Boston**.

Objective

- Describe the relationship between home density and Hubway Stations
- Use this relationship as a metric when considering potential locations for new Hubway Stations
- Provide a visualization of the proposed locations for Hubway Stations and how they interact with the existing Network.

Data Sets

- **Live Street Address Management (SAM) Addresses**

  Boston home addresses taken from “Analyze Boston”

- **Hubway Stations**

  Data on all the Hubway Stations as of July 2017

- **Hubway Stations Home Density**

  Calculated home density for an area inside a 1km radius around each Hubway Station

- **Possible Network Expansion Area**

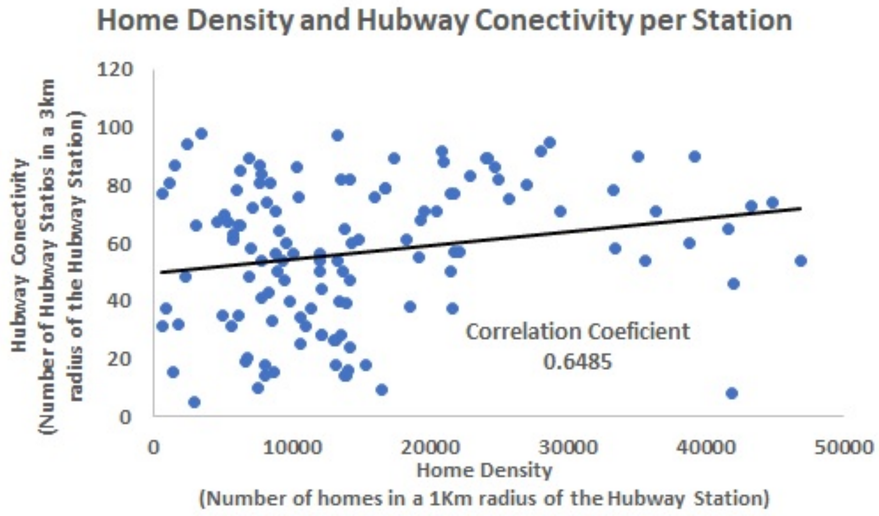
  Homes not within walking distance of a Hubway Station, but within riding distance

Methods

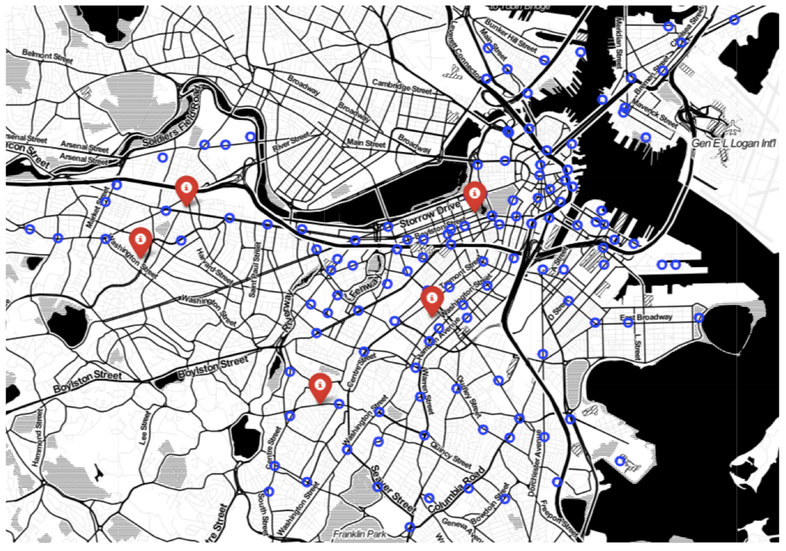
Derived the **Hubway Stations Home Density** and the **Possible Network Expansion Area** data sets from the **SAM Addresses** and the **HubwayStations**.

Calculated correlation of Home Density with Hubway Stations using the **Hubway Stations Home Density** data set.

Ran the **k-means** algorithm, with different specifications, on the **Possible Network Expansion Area** in order to find possible locations for new Hubway Stations. Later calculated Home Density for the possible locations and selected the locations that exceeded the average Home Density of the exciting Hubway Stations.



Visualization of current Hubway Stations and proposed stations



Results

After running **k-means with 5 means**, using latitude and longitude as metrics, **the resulting points (means) have a high Home Density** in comparison with the mean of Home Density observed in the area with current Hubway supply (around 12,000 homes).

Results from clustering

Points	Latitude	Longitude	Home Density
0	42.345876	-71.142809	16,608
1	42.322953	-71.104480	16,144
2	42.353143	-71.071541	45,748
3	42.336638	-71.080658	19,316
4	42.353988	-71.133061	15,488

However, due to the spatial clustering without any other constraint, some of the points found are in relative close proximity to currently existing Hubway stations.

Fine Tuning Opportunities

The project may benefit from introducing some specifications that were omitted in this iterations due computational and time constraints.

- Clustering using Home Density (calculating a Home Density for each home) and adding distance constraints to k-means.
- Using trip data for each station to better understand the relationship between Home Density and demand.

These improvements will allow us to address our objective in a more effective way and generate results that are more precise.